State of New York
Department of Conservation
Water Power and Control Commission

The Configuration of the Rock Floor in Western Long Island, N. Y.

by

Wallace deLaguna and M. L. Brashears, Jr.

Prepared by the United States Geological Survey
in cooperation with the Water Power and
Control Commission

BULLETIN GW-13

ALBANY

1948

STATE OF NEW YORK
DEPARTMENT OF CONSERVATION
WATER POWER AND CONTROL COMMISSION

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M. L. Brashears, Jr. .... *District Geologist*

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INTRODUCTION

This report is an outgrowth of the studies that have been made of the complex problems of the water supply for the City of New York and the densely populated suburban area which adjoins it on Long Island. Prior to 1932, investigations were made only when the growth of population made existing public supplies inadequate, and necessity demanded expansion. Since 1932 there has been a more foresighted policy of continuing study and control, undertaken jointly by County, State, and Federal authorities. While the nature of or depth to bedrock was never a primary concern of any of this work, much information bearing on this subject was obtained and is included and discussed in this report.

There has been interest in the study of ground water of Long Island since the days of the earliest settlements, when the success of shallow wells along the margins of the island and other factors tended to concentrate the settlements near the ocean or Long Island sound, away from the belt of central hills where deeper wells would have been required. About the turn of the century, the available supplies of ground water in Kings County*, even when augmented by surface water and by well water from southern Nassau County, were proving inadequate and serious attention was turned to the problem of obtaining additional supplies. In 1898, at a time when the problem of finding sufficient potable water was also becoming serious in Manhattan, the five boroughs were consolidated into the City of Greater New York. Since that date the whole question of supplying this large area with water has been studied as a unit, and considerable progress has also been made with the physical unification of the supply system itself. In 1900 two reports (1, 2) were published on the broad general problem of the future supply for the City, and in 1903 there appeared a long report of the careful study of the question by the Burr-Hering-Freeman Commission (3). This last report is generally regarded as containing the first comprehensive analysis of the whole problem. From this study it was apparent that if legal restrictions were removed Brooklyn could greatly increase its withdrawals along the south shore of the Island, but that supplies from the surface-water sources north of the City would eventually be needed in Brooklyn as well as in the other four Boroughs. This prediction has proved correct. As a result of the report (3) the Brooklyn water-supply system was extended along the south shore, but it was not until 14 years later or 1917, that water from streams in the Catskill region was piped to Brooklyn. During that period, the local supplies had become increasingly inadequate so that a serious shortage developed, but with the arrival of the first water from Ashokan reservoir this situation was temporarily relieved.

While the Burr-Hering-Freeman Commission was preparing its report (3), the U. S. Geological Survey, in cooperation with that commission, was making a related study of the general geology and ground-water resources of Long Island. The results of this work were published in two Professional Papers, the first, on ground water, by Veatch in 1906 (4), the second, on geology by Fuller, in 1914 (5). While not dealing directly with the engineering problems of water supply, these reports nevertheless did provide a much needed general picture of underground conditions.

Not until 1933, when the problem of water for Kings and Queens Counties again became serious, was further systematic work undertaken. At that time, the City applied to the New York State Water Power and Control Commission for permission to increase the amount of water pumped in Kings, Queens and Nassau Counties, and studies were made in connection with this application (6). It developed then, for the first time, that excessive withdrawals in Kings County had already seriously depleted ground water supplies in Kings and parts of Queens Counties so that there was a need for a curtailment rather than an increase of pumpage. Shortly before that time, in January 1932, the Geological Survey began an intensive study of the ground water resources of Long Island that has been continued in cooperation with the Water Power and Control Commission, the Nassau County Department of Public Works, the Suffolk County Board of Supervisors, and more recently also with the Suffolk County Water Authority. As the studies have progressed, the magnitude and diversity of the problem have become more apparent, so that the present policy is one of continuing study and continuing control. Reports on different phases of this work have been published from time to time, but in no case are they final. New tables, maps, and accompanying descriptions will be released as additional information makes possible significant refinements and corrections.

The present report has been made possible by the cooperative effort of many persons and organizations. A considerable part of the bedrock data was furnished by the Water Power and Control Commission, the New York City Board of Water Supply, and the New York Department of Water Supply. Acknowledgement is made also to the many well drillers and owners who willingly made available their records. Messrs. Russell Suter, Water Power and Control Commission, L. P. Wood, New York City Board of Water Supply, and Angus D. Henderson, New York Department of Water Supply, offered many helpful suggestions and aided in locating unreleased data in the files of their respective organizations.

The data compiled by the U. S. Geological Survey are the result of the work of a number of geologists who have been assigned to the Long Island project. During the compilation of the map constructive criticism was offered by Mr. Russell Suter, Executive Engineer of the N. Y. Water Power and Control Commission, and his help in improving the map is gratefully acknowledged.

*Kings County is synonomous with the Borough of Brooklyn.

USES OF A BEDROCK MAP

Almost no water is pumped from the bedrock on Long Island. The rock is not permeable unless much broken or jointed. Even when encountered, the cracks and joints yield only small to moderate supplies of water, which in most cases is salty or otherwise of poor quality. The most useful information about the bedrock, at least from the point of view of the well driller or the engineer, is its depth below the surface, or below sea level, for this figure indicates the maximum depth to which wells are commonly drilled. Over much of the Island, the bedrock is immediately overlain by a highly permeable bed of sand and gravel, the Lloyd sand, which is one of the principal deep-seated sources of water, and in places is the only source of potable water. Therefore, the depth to bedrock is not only an index of the depth of wells planned to tap the Lloyd, but also the maximum profitable depth for all wells. It is also obvious that the depth to bedrock is a measure of the total thickness of the overlying younger sediments, and is therefore the obvious starting point for any predictions of the stratigraphic column, and so is an essential figure in estimating the depth to other water-bearing beds than the Lloyd.

At the northwestern end of the Island; in parts of Brooklyn, Astoria and Long Island City; the bedrock is at the surface or at such shallow depths as to influence the planning or construction of engineering structures. Where the bedrock has been observed or explored in detail its surface is very irregular. Because of the scale of the enclosed map and the irregular scattering of the source data the map cannot be used to supply the detailed information needed by engineers. However, the map does serve to show those areas in which rock lies at shallow depth and in which test drilling will be needed, and should emphasize the need for this work, in planning structures.

The depth to bedrock is also of interest in connection with a number of problems which are now regarded as of purely scientific interest. That section of the bedrock which is still overlain by the Cretaceous beds, and this includes most of the area shown, must represent the late Jurassic or early Cretaceous peneplain surface which has been modified by subsequent erosion where it appears at the land surface. This and related physiographic studies may seem to have little practical significance, but experience has shown repeatedly that only a thorough understanding of the whole geologic history of an era can provide the necessary background for coping with the great variety of problems raised by present day technology.

EARLIER BEDROCK MAPS

Although many of the reports on the geology of New York City and its surrounding areas published during the 19th Century dealt with the bedrock of Manhattan, and so provided some basis for estimating its nature on Long Island, the first important contribution was in the New York City Folio by Merrill (7) published by the U. S. Geological Survey in 1902. The earliest map showing the estimated depth to bedrock on Long Island appeared in the report by Veatch (4) already referred to. Two years later, in 1905, the U. S. Geological Survey published a bulletin by Hobbs (8) which included a bedrock contour map of Manhattan, but added only a little direct information on Long Island. In 1910, W. O. Crosbp (9) compiled considerable information on depth to bedrock for the New York City Board of Water Supply and drew a bedrock contour map covering most of Kings and Queens Counties. This map was expanded and modified in 1922 by L. P. Wood of the New York Board of Water Supply (10). In 1924, Wood compiled a second map (11) showing detailed bedrock contours down to 200 feet below sea level for a narrow strip running along the East River from Rikers Island southwest to Gowanus Bay. This map was the principal source used by the present writers for this area. Suter, (12) in 1937, published a bedrock contour map of Kings and Queens Counties. In 1937, the Department of Borough Works of the Borough of Manhattan, published a map showing depths to bedrock in that area (13). This work was done in part as a project of the Works Progress Administration under the direction of C. P. Berkey and T. W. Fluhr. A second edition appeared in 1940. This map however gives very little information on Long Island.

SOURCES AND RELIABILITY OF DATA

The present map was compiled during 1943 and brought up to date in April, 1946. The data used are largely from published sources (4, 14, 15, 16) and from records in the files of the Water Power and Control Commission, the Board of Water Supply City of New York, or the U. S. Geological Survey. In the northwestern portions of Kings and Queens, where the surface of rock is less than 200 feet below sea level, the second map by Wood (11) was taken as a starting-point and data for wells drilled after 1924 were added in revising it. No attempt was made to collect all possible data from this area, for there is a great mass of it in some sections, particularly where the bedrock is very near the surface and is encountered therefore in many excavations and shallow test holes. Assemblying such data would be a very great task, as was shown by the work done in the Borough of Manhattan, referred to above (13) and is beyond the resources of the current program of ground-water studies. However, all wells reaching bedrock were considered and the data for the more significant wells were plotted.

Where the bedrock is more than 200 feet below sea level, all of the significant data available are from well logs and these form the basis for the contour lines shown. Where the depth of bedrock below sea level is more than 200 feet, the wells are plotted on the map and listed in the table of data so the reader is able to judge approximately at least the amount of data available for placing the contours. However, there are several points in connection with a map based on well logs that deserve emphasis.

In the great majority of cases—and the exceptions are noted in the table—the source of the information is the driller's log. Consequently his judgment is the basis for placing the location of the bedrock surface. While such a determination normally lies well within his competence, he is perhaps a little more prone than the ground-water geologist to mistake a large boulder for bedrock and also is more apt to confuse deeply weathered and altered bedrock for a clay or a clay-rich sedimentary deposit. Even conscientious and experienced judgment may therefore have indicated the bedrock surface some tens of feet above or below its proper position in some places. A more frequent but lesser source of error lies in the determination of the elevation above sea level of the reference point for the well log. This figure, of course, must be utilized to obtain the elevation of bedrock. It is felt that such errors seldom exceed a few feet, although in a very few cases they may be as much as ten feet, or even more in the case of old data for wells which no longer exist. As the Geological Survey visits and checks the logs of most of the wells now being drilled, the amount and proportion of reliable data has been steadily increasing since the cooperative studies began in 1932.

TYPES OF BEDROCK

Information on the formations making up the bedrock is best obtained from a study of areas where they are exposed at the surface. Although there are a few small exposures in Kings and Queens Counties, most of the useful exposures are to the west and north in Manhattan and the Bronx (8, 17, 18). Drill-cores and cuttings are adequate to permit extrapolation of the surface mapping eastward and southward under the cover of younger formations, but they do not provide a satisfactory method of studying formations not exposed at the surface. The information available suggests that the bedrock consists of three formations originallly sedimentary but now greatly altered by metamorphism, and several somewhat younger, but still very ancient, types of igneous rocks which intrude them. Even though some of the well-logs indicate the nature of the bedrock or even show a formational name, these identifications are too scanty and unreliable to make it possible to map the formations even approximately, and this has not been attempted.

Fordham gneiss: The oldest formation present is the Fordham gneiss so called from exposure in Fordham Heights in the Borough of the Bronx. On Long Island this formation is exposed at the surface in Astoria and beyond doubt underlies much of the adjacent area. It is composed of conspicuously banded biotite gneiss which locally grades into schist. In places it contains a few beds of impure limestone and quartzite. Quartz, biotite and feldspar are the abundant minerals, and muscovite is rare. Much of it is certainly sedimentary in origin, but some of it may have been igneous.

Ravenswood granodiorite: This rock intrudes the Fordham gneiss in many localities, but the largest exposure is in the Ravenswood section of Long Island City opposite Welfare Island. The formation ranges in composition from granite to diorite, but the term granodiorite is appropriate for much of it, and can be applied to all. While somewhat foliated, it is not typically streaked or gneissic and is unquestionably of igneous origin. There has been apparently no thorough petrologic study of this or the possibly related smaller pegmatite and granitic bodies so widely scattered through all the basement rocks, and it is impossible to give the relations or chronology of these igneous formations.

Inwood limestone: The Inwood limestone overlies the Fordham gneiss, and grades into it along the contact. The Inwood is a coarsely granular soft impure dolomitic marble and where cut by tunnels in northern Manhattan and the Bronx it is about 750 feet in thickness. It commonly contains coarse flakes of a brown mica (phlogopite) and small amounts of other minerals such as tremolite, chlorite and garnet, formed by the recrystallization of original impurities. The cohesion between the individual grains is weak, so that the rock typically weathers into coarse angular grains resembling superficially a coarse sand. Unlike many marbles therefore this rock is weak and forms low areas in the topography. On Long Island it has been found at Hallet's Point and elsewhere in Astoria, but apparently underlies only small areas at most and has not been identified farther out on the Island where the bedrock lies deeper.

Manhattan schist: The Manhattan schist underlies most of the southern part of Manhattan and extends into at least parts of Brooklyn. It is a coarsely crystalline schist with a marked foliation, and is composed largely of biotite, muscovite and quartz, with minor amounts of garnet, feldspar, epidote and hornblende. It is intruded by many small sills and dikes of pegmatite and granite and was also cut, at an earlier date, by a smaller number of basic intrusives now altered to serpentine.

All of these formations which make up the bedrock of the area are of great geologic age and quite possibly all four are pre-Cambrian. Attempts to correlate them with other formations elsewhere in the State or in other States, have not been very fruitful. They have been folded at least once and deformed by faulting during several periods. This metamorphism is as difficult to date as the formations themselves but the final period of important alteration came in the Appalachian Revolution, at the close of the Paleozoic, and the subsequent history of the bedrock is entirely one of erosion.

EROSIONAL HISTORY OF THE BEDROCK

After the close of the mountain building of the Appalachian Revolution, the next fixed point in the geologic history of this general area came with the deposition of the red beds of the Newark group during the Triassic period. The intervening time had been sufficient for great erosion, for the surface on which these beds were deposited was one of far less relief than presumably had existed at the close of the Appalachian Revolution. No Triassic rocks have been identified in the well records of Long Island, but the long belt of them which forms the lowlands of the Connecticut River Valley, and extends south to New Haven, may well pass under the Sound and form the bedrock of Long Island some five or ten miles east of Port Jefferson. Since its depth below sea level in that area would probably lie between 1000 and 1500 feet, it would require a well much deeper than those commonly drilled in this area to determine the existence of Triassic rocks. It is of significance in that the existence of this formation, both in Connecticut and in New Jersey, serves to date the deformation and erosion of the still older rocks described above, and of the Fall Zone peneplain described below.

At no great time after their deposition, geologically speaking, and probably during the latter part of the Triassic, the red beds and associated basalt flows and sills were cut into long blocks by a series of normal faults of great displacement, and the blocks tilted, in New Jersey to the west, in Connecticut to the north by dips of up to 15°. This block faulting must have once again made low mountains at least where, near the start of the period, there had been a relatively low relief. Starting late in the Triassic or early in the Jurassic, there began that period of erosion which was the final step in the development of most of the bedrock surface of the Island. This erosion lasted into Cretaceous time when the transgression of the sea began the deposition of the sediments which still form the bulk of the Island. The surface which was formed by this erosion has been named the Fall Zone Peneplain by Sharp (19) and has been studied still further by Douglas Johnson and his fellow workers (20, 21, 22). As described by them it reaches from Long Island, the most northerly point at which it can be identified, south along the inner margin of the Coastal Plains and up around the Mississippi embayment. Through virtually all of this great distance it was described as having a uniform slope seaward of 30 feet to the mile, although near Washington, D. C., it is greater, about 100 feet to the mile, and in North Carolina it is less. The present work shows that in Long Island the slope is 75 or 80 feet to the mile.

At one time, this surface was correlated with the so-called Kittatinny and Schooley peneplains which form ridge crests at an altitude of about 4000 feet along the higher parts of the Appalachian Highlands, roughly 100 miles inland from the "outcrop" of the Fall Zone Peneplain. However, as Johnson (20) and Shaw (22) have pointed out, the slopes of these surfaces and the later peneplains which are found at lower levels is very much less, about 5 to 15 feet to the mile, and the correlation seems doubtful. Johnson imagined that a reconstruction of this Fall Zone Peneplain would carry it well above the Schooley Peneplain, but this is a doubtful extrapolation. The slope of the Fall Zone Peneplain is known from a study largely of well records confined to a narrow belt along the inland margin of the Coastal Plain. To project this slope inland for 60 to 100 miles is straining the data, particularly since it is believed that this whole area has been warped during the intervening period. The writers have no reason to question the conclusion by Johnson that the Fall Zone Peneplain is much older than, and quite unrelated to, the Schooley, but to them the extrapolation of the slope is not a valid method of attack.

Nature of the Fall Zone Peneplain. While the studies of Johnson and others gave a broad picture of the Fall Zone Peneplain, and served to show its great extent, its uniformity and its proper place in the long sequence of geologic history, the data available to these workers was scanty and scattered, and did not provide a detailed picture of any part of the surface. The unusually large number of wells in western Long Island provide the best detailed picture of this surface so far available. In the western tip of the Island, where the bedrock is near sea level or not far below it, post-Cretaceous erosion has stripped off the Cretaceous cover and cut into the bedrock in an irregular pattern and to a depth, in places, of more than a hundred feet. It is approximately true that the bedrock is still covered with Cretaceous sediments where it lies 150 feet or more below sea level, and only where it is still so covered does its surface preserve with certainty the Fall Zone Peneplain. A study of the pattern of the contours below 150 feet and their relation to the depths of individual wells suggests that the original surface, as a whole, was nearly flat, but that it had a maximum local relief of perhaps 80 to 100 feet.

The depth of weathering of the bedrock as shown by the well logs is very variable, being only a foot or two in some places, but over twenty feet or even forty feet in others. No actual study of the depth of weathering is possible from the data available, as the notations in the drillers' logs do not make it possible to distinguish bedrock which has weathered to clay from a sedimentary clay, nor are the terms "fresh bedrock" or "soft bedrock" even when used, entirely reliable. Presumably the deep weathering took place during the latter part of the interval when the peneplain was formed, when the surface was nearly level and erosion slow. If this was the case then in some places the basal Cretaceous beds must have been laid over this residual clay without removing it, while in other places the clay or weathered rocks seem to have been first washed away, for there are places where the Cretaceous deposits rest directly on fresh rock. It is possible that all the weathering took place after the deposition of the Cretaceous sediments, but lacking any positive evidence to this effect, weathering at the surface seems more probable.

Post-Cretaceous Erosion. While there were unconformities during the Cretaceous which are of importance in interpreting the relations of the several formations of that age, there does not seem to have been any important erosion of the bedrock during that period. There is no certain record of Tertiary deposition on Long Island, although there probably was both deposition and erosion during that long interval. During the Pleistocene, however, there was considerable change, for the advance and retreat of the ice sheets at times brought in and deposited till, sand, or clay, and at times caused deep erosion. This erosion cut into the bedrock at the northwestern tip of the Island where it lies less than 150 feet below sea level. The information on the shape of the bedrock here is relatively very good, partly because this area is heavily populated and so more wells and excavations have been made. It was for this reason that a 50 foot contour interval was used here rather than the 100 foot interval used for the rest of the map.

The pattern of the contours where the bedrock lies less than 200 feet below sea level is far more complex than where the bedrock lies deeper. There are two reasons for this. In the first place, as mentioned above, there are more data here, and so more detail is revealed and can be shown. It seems also to be that the Pleistocene erosion which in this area reached down to about 150 to 200 feet below sea level, produced a greater and more complex relief than had previously existed, so that the greater complexity of the map in this area reflects a difference which exists in nature, as well as the greater detail of available data.

The Pleistocene erosion is commonly regarded as the product of the silt and debris laden water which flowed out from the ice sheet. Such melt water is typically a powerful tool, not only because of the rock load which it carries, but also because of the sudden floods of large volume which enable it to cut and scour rapidly and to great depth. During the periods of maximum ice advance, sea level was lowered and the rivers were therefore able to cut considerably below their present base level. In the southeastern tip of Manhattan Island, the scouring cut one hole into the bedrock which reaches 200 feet below sea level and 150 feet below the solid rock which forms its rim. To the west, the bedrock gorge of the Hudson River reaches an unknown depth of at least several hundred feet below sea level. These irregular and deeply pocketed channels have been filled in with glacial outwash and later river and marine sediments so that today little evidence of them is to be found in the present land surface.

The well records in the central and eastern part of the area shown, where the bedrock was never entirely stripped of its Cretaceous cover, show no evidence of any such deep and irregular scouring of the bedrock, and although the data is spotty and incomplete, there can be little doubt that this marked difference does in fact exist. There was Pleistocene erosion here by streams emerging from the melting ice, but their channeling does not, as far as is now known cut deeper than the Cretaceous.

There are few deep wells on Long Island east of the area shown on the present map. The only wells reaching bedrock are at Orient Point and Greenport, at the northeast end of the island. These show that the dip of the bedrock surface swings here from southeast to south, but not enough information is provided to draw bedrock contours. The presence of abundant fresh water at relatively shallow depths makes it appear unlikely that future well drilling will provide much additional information on the depth to bedrock for eastern Long Island. In western Long Island more data will be secured in years to come, and will provide a more detailed picture of the location of the bedrock surface than is given here.

EXPLANATION OF TABLE

Column 1—Well Number. This column follows the numbering system adopted in 1937 and now in general use. Numbers are assigned in sequence as information is obtained, and have no bearing on location. Numbers in parenthesis preceded by a V refer to numbers used by Veatch (4).

Column 3—Map Coordinates. The coordinates designate the five-minute rectangle in which the well is located by number and letter in the indexed margins, and indicate distances of the well in miles north and west of the southeast corner of that rectangle.

Column 4—Altitude of Land Surface. These figures give altitude of land surface above mean sea level and may have been measured in the field or estimated from a topographic map. In a few cases such estimated elevations may be in error by as much as 10 feet.

Column 5—Depth of Bedrock. These figures give the depth of the bedrock surface below mean sea level, unless otherwise noted. Where followed by an "F" the figure gives elevation of a surface reported as fresh or hard rock, where followed by a "W" rock was reported as weathered. Where no letter follows, no information is available on condition of rock.

Column 6—Type of Bedrock. Identification of bedrock, except where noted under "Remarks", is based on the driller's log and may not be reliable.

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
B1	Triborough Bridge Authority, Old Ferry Point	3D, 4.3 N., 0.1 W.	2	60 W 63 F	Mica Schist	....
B2	do	4D, 4.0 N., 4.3 W.	0 (water)	98 W 99 F	do	....
B3	City of N. Y., Dept. of Public Works, Throgs Neck	4D, 4.8 N., 3.6 W.	9	50	Pegmatite Schist	....
B4	U. S. Navy, Harts Island	4E, 1.8 N., 1.0 W.	10	2	Mica Schist	....
K1	Rubel Ice Corp., Coney Island	2A, 0.4 S., 3.7 W.	5	625	Granite	Bedrock at 673 feet. No record, 575 to 673 feet. Bedrock assumed to be at about 625 feet.
K9	Royal Baking Powder Co., South Brooklyn	2C, 0.5 N., 4.0 W.	4	145	....	....
K12	Sperry Gyroscope Co., Inc., Brooklyn	2C, 2.2 N., 3.8 W.	49	50 F	....	....
K23	Reid Ice Cream Co., Brooklyn	2C, 1.1 N., 2.6 W.	57	170 F	....	....
K49	N. Y. Quinine & Chemical Works, Williamsburg	2C, 3.7 N., 2.2 W.	18	114	Granite	....
K50	Shultze Beverage Co., Williamsburg	2C, 3.7 N., 2.2 W.	16	141	....	....
K105	Y. M. C. A., Brooklyn	2C, 1.3 N., 3.1 W.	62	150	....	Bedrock at 204 feet. Record missing, 72 to 204 feet. Bedrock assumed to be at about 150 feet.

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
K110	St. George Hotel, Brooklyn	2C, 2.2 N., 4.0 W.	72	88	....	....
K261	Metropolitan Theatre, Loews, Brooklyn	2C, 1.8 N., 3.8 W.	35	59	....	....
K277	Joe's Restaurant, Brooklyn	2C, 1.5 N., 3.3 W.	37	109	Schist	....
K290	Melba Theatre, Loew's, Brooklyn	2C, 1.5 N., 3.5 W.	39	65	....	....
K320	F. W. Woolworth Co., Brooklyn	2C, 1.5 N., 3.4 W.	38	75	Mica Schist	....
K414	Hotel Touraine, Brooklyn	2C, 2.0 N., 4.0 W.	85	45	Gneiss and Granite	....
K458	American Sugar Refining Co., Williamsburg	2C, 3.3 N., 2.6 W.	5	173	....	....
K461	Knickerbocker Ice Co., Greenpoint	2C, 3.8 N., 1.2 W.	33	192	Mica Schist	....
K465	Eastern Farms Products Co. Inc., Greenpoint	2C, 4.8 N., 2.0 W.	10	55	....	....
K514	N. Y. Water Service Corp., Flatbush	2B, 4.0 N., 0.6 W.	26	441	....	Reported by F. G. Wells as "probably diabase".
K524	do	2B, 5.1 N., 0.7 W.	33	349	....	....
K526	do	2B, 5.7 N., 2.3 W.	82	289	....	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
K528	N. Y. Water Service Corp., Flatbush	2B, 5.2 N., 1.7 W.	61	298	....	Reported as, "Solid rock or large boulder".
K528T	do	2B, 5.2 N., 1.7 W.	61	295	Mica Schist	....
K531	do	2B, 5.7 N., 2.3 W.	82	288	Schist	....
K532	do	2B, 3.7 N., 1.5 W.	11	409 W	Granite	....
K534	do	2B, 3.9 N., 1.4 W.	17	404 W 416 F	Gneiss	....
K579	Socony-Vacuum Oil Co. Inc., Greenpoint	2C, 4.2 N., 1.3 W.	7	75	....	....
K619	Kings County Ice & Fuel Co., East New York	3B, 5.6 N., 3.5 W.	25	426	....	Reported as, "Bedrock or boulder".
K637	Rainbow Theatre, Williamsburg	2C, 2.8 N., 1 4 W.	35	168	....	....
K638	David E. Kennedy, Inc., South Brooklyn	2C, 0.4 N., 4.0 W.	9	166	....	....
K640	City of New York	1C, 2.2 N., 0.2 W.	0 (water)	68.3	Pegmatitic Gneiss	....
K641	do	1C, 2.5 N., 0.1 W.	do	64.3	Granite Gneiss	....
K642	do	1C, 2.6 N., 0.0 W.	do	92.3	Mica Schist	....
K654	City of N. Y., Bd. of Water Supply, Brooklyn	2C, 1.2 N., 3.9 W.	25	100	Granodiorite	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
K655	City of N. Y., Bd. of Water Supply, Brooklyn	2C, 1.3 N., 3.4 W.	39	148 W 175 F	Gneiss	....
K656	do	2C, 1.4 N., 3.4 W.	43	116	Quartzite and Gneiss	....
K657	do	2C, 1.0 N., 3.1 W.	44	162	....	....
K658	do	2C, 1.8 N., 2.7 W.	61	120	Granodiorite	....
K659	City of New York, Brooklyn	2C, 1.4 N., 3 2 W.	38	106	....	....
K660	City of New York, Brooklyn	2C, 1.5 N., 3.3 W.	35	67	Gneiss	....
K661	City of New York, Bd. of Water Supply	2C, 1.8 N., 3.2 W.	54	74	Granodiorite	....
K662	City of New York, Dept. of Bridges, Brooklyn	2C, 2.7 N., 3.8 W.	0	98	....	....
K663	City of New York, Bd. of Water Supply, Brooklyn	2C, 2.1 N., 2.8 W.	14	161	Granodiorite	....
K664	City of New York, Bd. of Water Supply, Williamsburg	2C, 2.4 N., 2.5 W.	17	142	Granodiorite	....
K665	do	2C, 2.2 N., 2.6 W.	12	140	do	....
K666	do	2C, 2.6 N., 2.2 W.	55	139	do	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
K667	City of New York, Bd. of Water Supply, Williamsburg	2C, 2.8 N., 2.0 W.	45	143	Granodiorite	....
K668	City of New York, Bd. of Water Supply, South Brooklyn	2C, 1.0 N., 4.1 W.	57	123	Gneiss	....
K669	do	2C, 1.0 N., 4.3 W.	48	114	do	....
K670	City of New York, Bd. of Water Supply, Williamsburg	2C, 2.9 N., 2.0 W.	30	116	Granodiorite	....
K671	City of New York, Bd. of Water Supply, Brooklyn	2C, 2.5 N., 3.6 W.	37	76	Gneiss	....
K672	City of New York, Bd. of Water Supply, Williamsburg	2C, 3.0 N., 1.9 W.	20	131	Granodiorite	....
K673	do	2C, 3.2 N., 1.8 W.	14	162	Gneiss and Granodiorite	....
K674	U. S. Navy Dept., Brooklyn	2C, 2.6 N., 3.0 W.	12	85	....	Depth of bedrock in 8 borings ranges from 57 to 122 feet, averages 85 ft.
K675	City of New York, Bd. of Water Supply, Williamsburg	2C, 3.6 N., 0.7 W.	13	190	Gneiss and Granodiorite	....
K676	City of New York, Bd. of Water Supply, Brooklyn	2C, 1.3 N., 3.6 W.	28	127	Gneiss	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates,	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
K677	City of New York, Bd. of Water Supply, Williamsburg	2C, 3.4 N., 1.0 W.	19	177	Gneiss and Granodiorite	....
K678	do	2C, 3.3 N., 1.4 W.	39	161 W 162 F	do	....
K679	City of New York, Bd. of Water Supply, Greenpoint	2C, 3.8 N., 1.3 W.	35	163	do	....
K682	Quebracho Extract Co., Greenpoint	2C, 4.6 N., 2.3 W.	10	43	....	....
K684	City of New York, Dept. of Bridges, Brooklyn	2C, 2.5 N., 4.1 W.	5	98	....	....
K685	City of New York, Bd. of Transportation, Brooklyn	2C, 2.6 N., 3.7 W.	7	73	....	....
K686	City of New York, Dept. of Docks, Williamsburg	2C, 3.1 N., 2.8 W.	0	146	....	....
K687	City of New York, Bd. of Water Supply	2C, 2.6 N., 2 4 W.	46	129 W 130 F	Granodiorite	....
K688	City of New York, Dept. of Docks, Williamsburg	2C, 3.8 N., 2.5 W.	0 (water)	107 F	....	....
K689	City of New York, Dept. of Water Supply, Greenpoint	2C, 4.0 N., 1.0 W.	31	109 W 111 F	Granodiorite	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
K690	City of New York, Bd. of Water Supply, Greenpoint	2C, 3.5 N., 1.6 W.	12	161 W 162 F	Granodiorite	....
K691	City of New York, Bd. of Water Supply, Williamsburg	2C, 3.4 N., 1.7 W.	20	122 W 147 F	do	....
K692	City of New York, Dept. of Docks, Greenpoint	2C, 4.7 N., 1.5 W.	3	82	....	....
K694	City of New York, Bd. of Water Supply, Brooklyn	2C, 1.3 N., 3.7 W.	16	88	Gneiss	....
K700	N. Y. Housing Association, South Brooklyn	1C, 0.6 N., 0.2 W.	6	108 W 121 F	do	....
K702	City of New York, Bd. of Water Supply, South Brooklyn	2C, 1.1 N., 4.0 W.	31	85	do	....
K703	do	1C, 0.8 N., 0.2 W.	18	103	do	....
K704	N. Y. Housing Association, South Brooklyn	1C, 0.6 N., 0.4 W.	7	121 W	....	Reported as, "Sand and clay, decomposed, micaceous".
K705	City of New York, Dept. of Docks, South Brooklyn	1C, 0.8 N., 0.8 W.	10	112 W 121 F	....	Reported as, "Rock, gray, containing seams of mica".
K708	Long Island Railroad, Brooklyn	1C, 1.7 N., 0.0 W.	6	82	Gneiss	Reported as, "Gneiss, micaceous".

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
K709	City of New York, Bd. of Water Supply, Brooklyn	2C, 2.3 N., 3.6 W.	58	61	Gneiss	....
K710	City of New York, Bd. of Transportation, Greenpoint	2C, 4.6 N., 2.0 W.	13	28 W 31 F	....	....
K711	City of New York, Dept. of Docks, Greenpoint	2C, 4.5 N., 1.3 W.	0	74	....	....
K717	City of New York, Bd. of Water Supply, Williamsburg	2C, 2.8 N., 2.0 W.	45	141	Granite	....
K718	City of New York, Bd. of Transportation, Bay Ridge	1B, 2.7 N., 1.2 W.	80	296	....	....
K723	City of New York, Bd. of Transportation, Brooklyn	2C, 2.3 N., 3.7 W.	57	72	....	....
K725	City of New York, Bd. of Water Supply, Brooklyn	2C, 1.2 N., 3.7 W.	14	80	Gneiss	....
K728	do	2C, 2.1 N., 3.6 W.	36	81	do	....
K729	do	2C, 2.0 N., 3.0 W.	45	108	do	....
K730	do	2C, 1.9 N., 3.5 W.	36	68	do	....
K731	do	2C, 1.3 N., 3.6 W	23	160 W 167 F	do	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
K737	Long Island Railroad, Brooklyn	1C, 1.9 N., 0.1 W.	5	83	Mica Gneiss	....
K750	Brooklyn Bridge, Brooklyn	2C, 2.6 N., 4.1 W.	0	89	....	....
K921	Knox Hat Co., Brooklyn	2C, 0.7 N., 2.4 W.	115	116	Granite	....
K930	C & J Cirillo Corp., South Brooklyn	2C, 0.7 N., 3.6 W.	20	160	....	....
K956	do	2C, 0.7 N., 3.6 W.	-21	161	....	....
K1073	B. F. Keith Corp., Brooklyn	2C, 1.5 N., 3.3 W.	19	75	....	....
K1271	Brooklyn Rapid Transit Co., South Brooklyn	1B, 5.1 N., 0.5 W.	5	207	....	....
K1276	Mergenthaler Linotype Co., Brooklyn	2C, 2.1 N., 2.6 W.	13	71	....	....
K1279	U. S. Navy Dept., Brooklyn	2C, 2.4 N., 3.2 W.	12	91	Granite and Schist	....
K1280	do	2C, 2.2 N., 3.1 W.	12	84	Granite	....
K1281	do	2C, 2.7 N., 3.0 W.	12	86	do	....
N23	Citizens Water Supply Co., Great Neck	5D, 2.0 N., 3.5 W.	15	452	....	No record for depths of 419 to 452 feet. Possibly weathered bedrock.
N24	Manhasset-Lakeville Water District, Manhasset	5D, 2.9 N., 2.3 W.	8	452	....	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
N31	Citizens Water Supply Co., Kings Point	5D, 4.5 N., 3.9 W.	20	348	....	....
N32	Port Washington Water District, Port Washington	5E, 0.2 N., 1.6 W.	23	366	....	....
N33	do	5E, 0.2 N., 1.6 W.	23	345 W 346 F	....	....
N36	Village of Sands Point, Sands Point	5E, 1.3 N., 2.6 W.	50	195 W	....	Thirty-five feet of weathered bedrock penetrated without reaching fresh bedrock.
N37	do	5E, 1.3 N., 2.6 W.	60	159 W	....	About 250 feet east of N36. Weathered bedrock penetrated one foot.
N38	Harry F. Guggenheim, Sands Point	5E, 1.7 N., 1.4 W.	75	340	....	....
N83	Village of Hempstead, Hempstead	6C, 3.7 N., 1.9 W.	65	938	....	....
N118	Locust Valley Water District, Locust Valley	6E, 3.0 N., 0 2 W.	71	407	....	....
N119	do	6E, 3.0 N., 0.2 W.	80	498	....	About 1500 feet west of N118 and 200 feet northeast of N120.
N120	do	6E, 3.0 N., 0.2 W.	80	478	....	....
N122	J. F. Aldred, Lattingtown	6E, 4.7 N., 1.5 W.	5	467	....	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
N216	Mrs. Marion E. Scott, Hewlett Point	4D, 5.7 N., 0.2 W.	5	225	Granite	Description in Prof. Paper 44 of U. S. G. S., "Soft gray granite and mica veins, same character as found throughout Westchester County, N. Y."
N314	George Zabriskie, Sands Point	5E, 1.9 N., 3.2 W.	60	190	....	....
N687	Citizens Water Supply Co., Great Neck	5D, 3.2 N., 4.2 W.	10	310 W 350 F	Schist	....
N842	Sea Cliff Water Co., Sea Cliff	6E, 0.7 N., 3.6 W.	10	433	....	....
N906	Sea Cliff Water Co., Sea Cliff	6E, 0.7 N., 3.6 W.	10	425	....	....
N1298	Citizens Water Supply Co., Great Neck	5D, 1.7 N., 3.5 W.	15	366	....	....
N1328	Manhasset-Lakeville Water District, Manhasset	5D, 2.4 N., 0.7 W.	184	559 W	Mica Schist	Twenty-five feet of weathered bedrock penetrated without reaching fresh bedrock.
N1618	do	5D, 1.8 N., 1.9 W.	80	491 W 505 F	....	....
N1715	Port Washington Water District, Port Washington	5D, 4.8 N., 1.1 W.	96	413	....	....
N1716	Port Washington Water District, Port Washington	5D, 4.8 N., 1.1 W.	101	416	....	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
N1802	Manhasset-Lakeville Water District, Lake Success	5D, 0.4 N., 1.9 W.	132	614 W	....	....
N1926	U. S. Merchant Marine Academy, Kings Point	4D, 4.3 N., 0.5 W.	54	246 W	Chlorite Schist	....
N1927	U. S. Naval Receiving Station, Long Beach	6B, 0.4 N., 3.3 W.	8	1460	....	....
Q13	Ford Motor Co., Long Island City	2D, 0.1 N., 0.8 W.	24	64	....	....
Q16	Dings & Schuster, Inc., Astoria	3D, 1.7 N., 3.5 W.	19	79	....	....
Q17	H. L. Simons, Inc., Long Island City	2D, 0.0 N., 1.8 W.	17	9	....	....
Q27	Durkee Famous Foods, Inc., Elmhurst	3C, 5.3 N., 2.1 W.	60	241	....	....
Q31	Long Island Railroad Co., Glendale	3C, 2.8 N., 1.3 W.	70	421	Mica Schist	....
Q33	College Theatre, College Point	3D, 2.4 N., 0.7 W.	27	179 W 183 F	Granite	....
Q62	Knickerbocker Ice Co., Woodside	2D, 0.0 N., 0.2 W.	38	86	....	....
Q64	Knickerbocker Ice Co., Elmhurst	3C, 5.2 N., 2.6 W.	35	252	....	....
Q95	Jung Sun Wet Wash Co., Long Island City	2D, 0.5 N., 1.1 W.	7	87	....	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
Q161	The Atlantic Macaroni Co., Long Island City	2D, 0.0 N., 2.1 W.	5	9 W 145 F	....	Log reads, "Soft rock grading into hard rock", 9 to 145 feet.
Q165	Wm. Bradley & Son, Long Island City	2D, 0.5 N., 1.5 W.	12	7 (above M. S. L.)	Fordham Granodiorite	....
Q171	Loose-Wiles Biscuit Co., Long Island City	2C, 5.6 N., 1.3 W.	46	10	....	....
Q184	Calvary Cemetery, Long Island City	2C, 4.7 N., 0.1 W.	90	92	Gneiss	....
Q188	East River Gas Co., Long Island City	2D, 0.6 N., 1.4 W.	20	0	do	....
Q190	Jos. Gillies & Son, Long Island City	2C, 5.5 N., 2.0 W.	10	20	....	....
Q206	DeLuxe Theatre, Jackson Heights	3C, 5.5 N., 3.8 W.	47	170	....	....
Q223	Frederick Russell, Long Island City	2C, 4.9 N., 2.1 W.	10	12	Gneiss	....
Q227	A. E. Horn Co., Long Island City	2D, 0.1 N., 1.7 W.	5	3 (above M. S. L.)	do	....
Q228	Young & Metzner, Long Island City	2D, 0.1 N., 1.9 W.	2	4	do	....
Q229	D. G. Morrison, Long Island City	2D, 0.2 N., 1.8 W.	5	5 (above M. S. L.)	do	....
Q230	N. Y. Architectural Terra-cotta Co., Long Island City	2D, 0.3 N., 1.7 W.	22	7	....	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
Q231	John Good Cordage, Long Island City	2D, 0.7 N., 1.4 W.	5	15	Gneiss	....
Q232	S. & G. Witherspoon & Sons, Astoria	2D, 0.8 N., 1.4 W.	5	5 (above M. S. L.)	do	....
Q233	N. Y. Asbestos Co., Long Island City	2D, 1.0 N., 1.0 W.	5	26	....	....
Q236	Astoria Steel Co., Astoria	2D, 1.9 N., 0.9 W.	5	23	....	....
Q237	Lalance & Grosjean Mfg. Co., Woodhaven	3C, 1.4 N., 0.9 W.	40	516	....	....
Q262	Citizens Water Supply Co., (Formerly), Jackson Heights	3D, 0.5 N., 3.4 W.	15	123	Fordham Gneiss	....
Q263	City of N. Y., Dept. of Water Supply, Long Island City	2D, 0.1 N., 0.2 W.	38	80	Gneiss	....
Q268	City of N. Y., Dept. of Water Supply, Elmhurst	3C, 5.1 N., 2.6 W.	31	262	....	....
Q272	City of N. Y., Dept. of Water Supply, Forest Hills	4C, 3.5 N., 4.0 W.	13	457 W	Granite	Twenty-five feet of weathered granite penetrated without reaching fresh rock.
Q274	City of N. Y., Dept. of Water Supply, Flushing	4C, 5.6 N., 2.6 W.	20	387	do	Twelve feet of weathered bedrock penetrated without reaching fresh bedrock.

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
Q283	City of N. Y., Dept. of Water Supply, Flushing	4C, 5.7 N., 2.4 W.	27	415 W 420 F	Granite	....
Q298	Fleischmann Mfg. Co., Long Island City	2C, 4.6 N., 1.1 W.	15	109	....	....
Q299	Flower Estate, Long Island City	2C, 5.2 N., 0.2 W.	80	32	....	....
Q350	N. Y. Water Service Corp., Ozone Park	3C, 0.4 N., 0.1 W.	33	577 W	Mica Schist	Forty-five feet of weathered bedrock penetrated without reaching fresh rock.
Q369	Queens-Laurel Corp., Woodside	2C, 5.4 N., 0.3 W.	80	61 W	....	Twelve feet of soft gray rock penetrated.
Q374	Triboro Bridge Authority, Astoria	2D, 1.8 N., 0.5 W.	33	17	Mica Schist	....
Q375	N. Y. Housing Authority, Astoria	2D, 1.8 N., 0.9 W.	15	41 W	....	....
Q376	City of N. Y, Bd. of Water Supply, Long Island City	2D, 0.4 N., 0.4 W.	43	59	Gneiss and Granodiorite	....
Q377	do	2D, 0.8 N., 0.1 W.	64	3	Fordham Gneiss	....
Q378	do	3D, 1.0 N., 4.4 W.	75	7	do	....
Q379	do	2D, 0.6 N., 0.2 W.	52	74	do	....
Q380	do	3D, 1.2 N., 4.3 W.	78	10	do	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
Q381	City of N. Y., Bd. of Water Supply, Astoria	3D, 2.1 N., 3.4 W.	19	56	Fordham Gneiss	....
Q382	do	3D, 1.6 N., 4.0 W.	58	49	do	....
Q386	City of N. Y., Bd. of Water Supply, Long Island City	2C, 5.7 N., 0.5 W.	75	73	Granodiorite	....
Q387	City of N. Y., Dept. of Sanitation, Woodside	2C, 5.1 N., 0.6 W.	64	88 W 91 F	do	....
Q388	City of N. Y., Bd. of Water Supply, Woodside	2C, 5.3 N., 0 6 W.	70	106	Fordham Gneiss	....
Q389	do	2D, 0.2 N., 0.5 W.	35	28	do	....
Q390	City of N. Y., Dept. of Substructures, Long Island City	2C, 4.5 N., 0.9 W.	23	171	do	....
Q391	City of N. Y., Bd. of Water Supply, Maspeth	2C, 4.6 N., 0.8 W.	62	115	do	....
Q392	do	2C, 4.7 N., 0.7 W.	65	85	do	....
Q393	City of N. Y., Bd. of Water Supply, Long Island City	2C, 4.4 N., 0.7 W.	17	133	do	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
Q394	City of N. Y., Bd. of Water Supply, Long Island City	2C, 4.9 N., 0.7 W.	48	107 W 114 F	Fordham Gneiss	....
Q403	Reid, Rockaway Point	3A, 1.3 S., 4.1 W.	5	865	Granite	....
Q404	City of N. Y., Dept. of Sanitation, Astoria	2D, 2.2 N., 0.3 W.	43	8 (above M. S. L.)	Gneiss	Driller reports, "Solid gneiss."
Q405	City of N. Y., Bd. of Water Supply, Astoria	3D, 2.4 N., 3.4 W.	5	62 W 67 F	Fordham Gntiss	....
Q406	Triboro Bridge Authority, Astoria	2D, 2.1 N., 0.2 W.	53	24	Mica Schist	....
Q407	do	2D, 1.7 N., 0.3 W.	22	23	....	....
Q408	New York Housing Authority, Long Island City	2D, 1.3 N., 1.0 W.	6	42	Fordham Gneiss	....
Q411	City of N. Y., Bd. of Water Supply, Astoria	3D, 1.3 N., 4.2 W.	64	41	Ravenswood Granodiorite	....
Q412	City of N. Y., Bd. of Water Supply, Long Island City	3D, 0.9 N., 4.0 W.	66	42	Fordham Gneiss	....
Q413	City of N. Y., Bd. of Water Supply, Astoria	3D, 1.2 N., 3.8 W.	56	38	Granodiorite	....
Q414	City of N. Y., Bd. of Water Supply, Steinway	3D, 1.6 N., 3.5 W.	21	59 W 71 F	Ravenswood Granodiorite	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
Q415	City of N. Y., Bd. of Water Supply, Steinway	3D, 1.8 N., 3.3 W.	8	82	Ravenswood Granodiorite	....
Q416	do	3D, 2.0 N., 3.1 W.	0	89 W 106 F	do	....
Q417	do	3D, 0.4 N., 4.3 W.	46	54	Fordham Gneiss	....
Q418	City of N. Y., Bd. of Transportation, Long Island City	2C, 5.8 N., 2 0 W.	7	41	....	....
Q422	City of N. Y., Dept. of Sanitation, Long Island City	2C, 5.3 N., 2.2 W.	7	49	Gneiss	....
Q423	City of N. Y.. Bd. of Transportation, Long Island City	2C, 5.4 N., 2.0 W.	17	42	....	....
Q425	City of N. Y., Bd. of Water Supply, Long Island City	2C, 5.5 N., 0.6 W.	75	64	Fordham Gneiss	....
Q426	City of N. Y., Bd. of Water Supply, Woodside	2C, 5.6 N., 0 0 W.	63	64	do	....
Q427	do	2C, 5.3 N., 0.1 W.	91	121	Ravenswood Granodiorite	....
Q428	do	2C, 4.9 N., 0.2 W.	98	149	do	....
Q429	do	2C, 4.8 N., 0.5 W.	64	150	Fordham Gneiss	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
Q430	City of N. Y., Bd. of Water Supply, Maspeth	3C, 4.9 N., 4.4 W.	101	125	Fordham Gneiss	....
Q431	do	2C, 4.8 N., 0.1 W.	104	118 W 119 F	do	....
Q432	do	2C, 4.7 N., 0.1 W.	115	167	do	....
Q433	do	3C, 4.5 N., 4.4 W.	28	146	do	....
Q434	do	2C, 4.6 N., 0.1 W.	89	147	do	....
Q435	do	2C, 4.4 N., 0.2 W.	63	176	do	....
Q436	do	2C, 3.8 N., 0.4 W.	8	187 W 189 F	Gneiss and Granodiorite	....
Q437	L. M. Palmer, Maspeth	2C, 3.9 N., 0.1 W.	5	207	Fordham Gneiss	....
Q438	City of N. Y., Bd. of Water Supply, Maspeth	2C, 4.1 N., 0.2 W.	4	184	do	....
Q453	Allied Die Casting Co., Woodside	2C, 5.5 N., 0.6 W.	68	77	Granite	....
Q462	City of N. Y., Dept. of Water Supply, Bayside	4D, 0.8 N., 0.3 W.	7	393	....	Reported as, "White rock".
Q463	do	4D, 0.8 N., 0.3 W.	7	392	....	Reported as, "White rock and conglomerate".
Q465	do	4D, 0.8 N., 0.3 W.	5	396	....	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
Q467	City of N. Y., Dept. of Water Supply, Bayside	4D, 0.8 N., 0.3 W.	6	392	....	....
Q490	City of N. Y., Dept. of Water Supply, Whitestone	4D, 2.5 N., 3.9 W.	5	219	....	....
Q562	Jamaica Water Supply Co., Jamaica	4C, 2.1 N., 2.0 W.	23	649	Mica Rock	....
Q568	Jamaica Water Supply Co., St. Albans	5C, 2.3 N., 3.6 W.	50	811	Mica Rock	....
Q571	Jamaica Water Supply Co., Jamaica	4C, 2.5 N., 1.5 W.	30	600	....	....
Q572	do	4C, 2.1 N., 2.0 W.	25	650	Granite	....
Q586	City of N. Y., Dept. of Water Supply, Forest Hills	3C, 4.3 N., 0.3 W.	15	414	....	Reported as, "Possibly hard layer in Raritan", but depth corresponds with probable position of bedrock.
Q602	City of N. Y., Bd. of Water Supply, Woodside	2C, 5.8 N., 0.5 W.	50	85	Fordham Gneiss	....
Q603	City of N. Y., Bd. of Water Supply, Long Island City	2C, 4.5 N., 0.8 W.	69	109 W 111 F	do	....
Q608	Flower Estate, Long Island City	2C, 4.9 N., 1.1 W.	10	40	....	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet above mean sea level	Type of bedrock	Remarks
Q620	Martin Hummel, Long Island City	2D, 0.5 N., 0.7 W.	45	18	....	....
Q628	Mrs. Fleming, Long Island City	2D, 1.3 N., 0.8 W.	15	20	....	....
Q629	Ward's Ship Yards, Long Island City	2D, 1.5 N., 1.0 W.	5	17	....	....
Q630	Consolidated Gas Co., Long Island City	2D, 1.7 N., 0.4 W.	10	35	Gray Gneiss	....
Q669	Long Island Railroad, Tallman Island	3D, 3.2 N., 0.4 W.	10	100 W 140 F	Fordham Gneiss	Bedrock reported by Eckel as, "Quartzitic Fordham".
Q954	A. Cardani, Inc., Long Island City	2D, 0.7 N., 1.3 W.	12	15	....	....
Q962	Gordon Baking Co., Long Island City	2D, 0.2 N., 1.5 W.	15	30	....	....
Q966	Liquid Carbonic Co., Long Island City	2C, 5.5 N., 2.1 W.	8	37	....	....
Q1030	City of N. Y., Dept. of Water Supply, Rockaway Park	3A, 0.2 S., 0.1 W.	5	975 W 1017 F	Granite	Microscopic analysis of bedrock by C. M. Roberts, U. S. G. S., to be published elsewhere.
Q1032	Loew's Plaza Theatre, Corona	3D, 0.1 N., 1.6 W.	40	221	....	....
Q1085	Phelps Dodge Refining Corp., Long Island City	2C, 4.3 N., 0.6 W.	6	163 W 164 F	....	....
Q1086	Durkee Famous Foods, Elmhurst	3C, 5.4 N., 2.1 W.	60	289	....	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
Q1093	Ditmar's Theatre, Long Island City	2D, 2.1 N., 0.1 W.	53	11 (above M. S. L.)	....	....
Q1098	Etched Products Corp., Long Island City	2C, 5.4 N., 0 6 W.	65	69	....	....
Q1221	Ideal Roller & Mfg. Co., Long Island City	2D, 0.5 N., 1.3 W.	17	21 W 25 F	Granite	....
Q1246	Marblette Corporation, Long Island City	2D, 0.4 N., 0.9 W.	25	38	....	....
Q1257	Croyden Operating Co., Long Island City	2D, 0.9 N., 0.6 W.	30	17	....	....
Q1272	Beacon Theatre, Long Island City	2D, 0.5 N., 1.5 W.	10	8 (above M. S. L.)	....	....
Q1301	C. A. Willey & Co., Long Island City	2C, 5.7 N., 1 7 W.	8	15 W 18 F	Gneiss	....
Q1352	City of N. Y., Dept. of Public Works, Jackson Heights	3D, 1.6 N., 1.7 W.	13	169 W	....	Reported as. "Bedrock—soft at top, becoming harder with depth".
Q1353	Triboro Bridge Authority, Whitestone	4D, 3.3 N., 4.0 W.	0	142 W 155 F	Mica Schist	....
R1	N. Y. Quarantine Station, Hoffman Island	1A, 0.3 S., 2.8 W.	5	445	....	....

RECORDS OF WELLS THAT PENETRATE BEDROCK ON LONG ISLAND, NEW YORK (CONTINUED)

Well No.	Owner and Location	Map Coordinates	Altitude of land surface in feet above mean sea level	Altitude of bedrock surface in feet below mean sea level	Type of bedrock	Remarks
S34	B. F. Yoakum, Northport	9F, 0.6 N., 2.4 W.	5	596	....	Reported by driller as, "Sandstone".
S189	Long Island State Park Commission, Orient Point	Not shown on map	16	654	Schist	
S420	Greenport Water Works, Greenport	Not shown on map	16	654	Schist	....
S507	Orient Mfg. Co., Orient Point	Not shown on map	..	..	....	Bedrock reached at depth greater than 406 feet. No other information available.

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